

Ontario Geological Survey

Northern Ontario Engineering Geology Terrain Study 21

BLUE LAKE AREA

(NTS 52F/NW)

District of Kenora

Compliments of
by
ONTARIO
MINISTRY OF NORTHERN DEVELOPMENT
AND MINES
Not for resale



Ontario

Ministry of
Natural
Resources

Hon. James A.C. Auld
Minister

Dr. J.K. Reynolds
Deputy Minister

Ministry of
Northern
Affairs

Hon. Leo Bernier
Minister

Art Herridge
Deputy Minister

© OMNR-OGS 1980

Printed in Canada

THIS PROJECT WAS FUNDED BY
THE ONTARIO MINISTRY OF NORTHERN AFFAIRS
AND IS MANAGED BY
THE ONTARIO MINISTRY OF NATURAL RESOURCES

Every possible effort is made to ensure the accuracy of the information contained in this report, but the Ministry of Natural Resources does not assume any liability for errors that may occur. Source references are included in the report and users may wish to verify critical information.

Publications of the Ontario Ministry of Natural Resources and price list are available through the *Map Unit, Public Service Centre, Room 6404, Whitney Block, Queen's Park, Toronto*, and the *Ontario Government Bookstore, 880 Bay Street, Toronto*.

Orders for publications should be accompanied by cheque or money order payable to the *Treasurer of Ontario*.

ISSN 0709-4671
ISBN 0-7743-4297-8

Parts of this publication may be quoted if credit is given. It is recommended that reference to this report be made in the following form:

Roed, M.A.

1980: Blue Lake Area (NTS 52F/NW), District of Kenora; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study 21, 14 p. Accompanied by Map 5058, scale 1:100 000.

CONTENTS

	Page
1.0 Introduction	1
2.0 Geologic Setting	2
2.1 Bedrock Geology	2
2.2 Quaternary Geology	3
2.3 Physiography	4
3.0 Engineering Terrain Units	4
3.1 Bedrock	5
3.2 Moraine	7
3.3 Glaciofluvial	10
3.4 Glaciolacustrine	11
3.5 Alluvial	12
3.6 Organic	12
4.0 References	13

TABLE

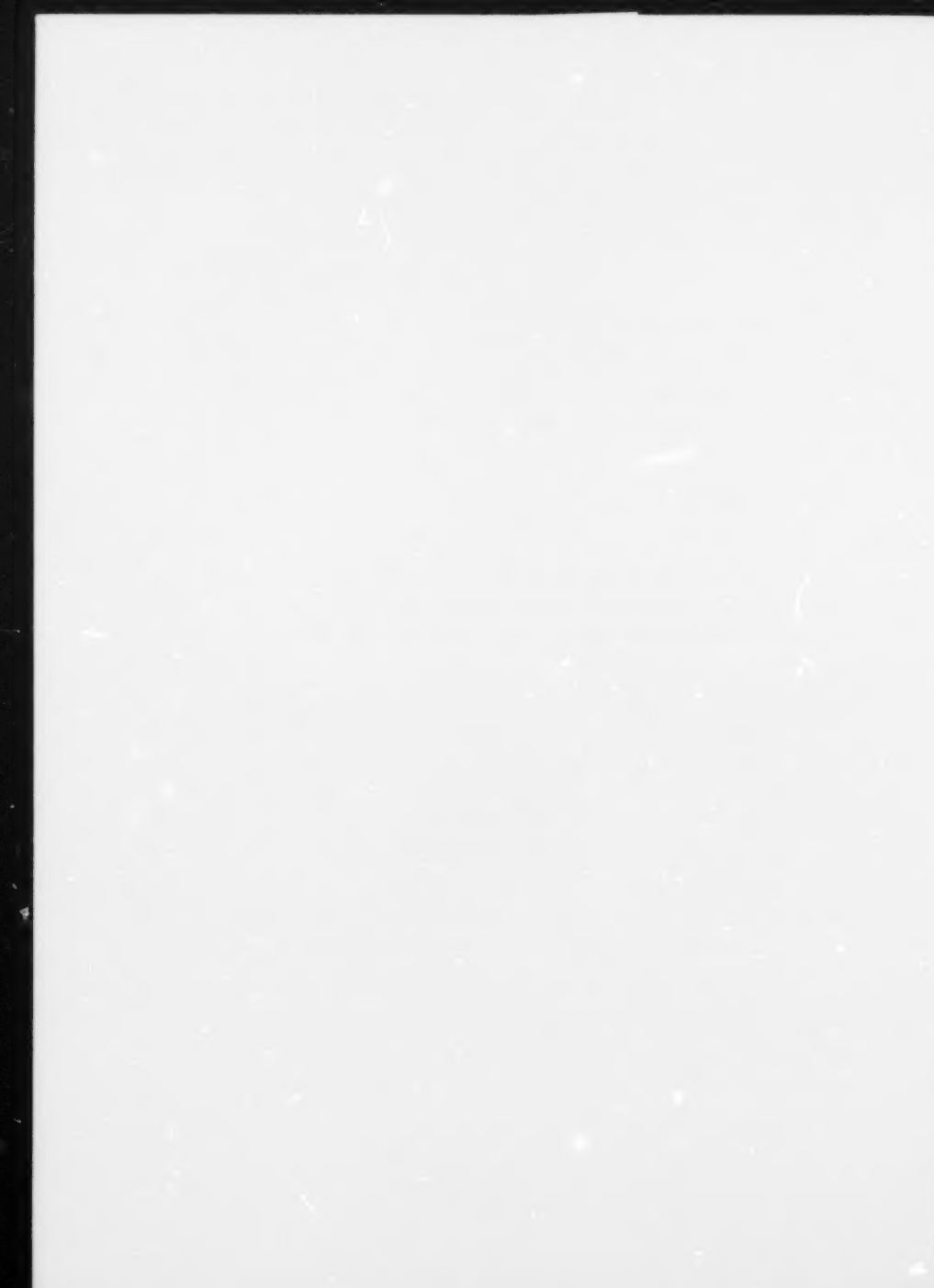
1 - Summary of terrain unit characteristics and engineering significance	8, 9
--	------

FIGURE

1 - Diagrammatic sketch showing typical terrain types and their representative letter symbols	6
---	---

MAP (accompanying report)

Map 5058 (coloured) - Northern Ontario Engineering Geology Terrain Study,
Data Base Map, Blue Lake (NTS 52F/NW). Scale 1:100 000.



Northern Ontario
Engineering Geology Terrain Study 21

BLUE LAKE AREA

(NTS 52F/NW)

District of Kenora

by

M.A. Roed¹

1.0 INTRODUCTION

This report and the accompanying map present the results of an engineering geology terrain study for the Blue Lake area, District of Kenora. The area, which covers NTS block 52F/NW, lies between Latitudes 49°30'N and 50°00'N and Longitudes 93°00'W and 94°00'W. The report and map form part of a series of publications which provide similar terrain data for approximately 370 000 km² of northern Ontario.

The purpose of this study is to provide an inventory of engineering geology terrain conditions that will serve as a basic data framework for engineering and resource planning activities, at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5058, accompanying this report).

Interpretation of 1969 and 1970 black and white aerial photographs, at a scale of approximately 1:50 000, formed the basis of the terrain

¹ Geological Consultant, Geo-analysis Limited, Ottawa, Ontario.

mapping process. The interpretation was compared to relevant published information for the study area. In addition, two automobile field trips were conducted in 1978, an early reconnaissance trip to identify major terrain units and a later one to verify the airphoto interpretation. Thus, the Data Base Map represents a reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. Further discussion on the mapping techniques, legend format, and possible uses of this engineering geology information is available in the Ontario Engineering Geology Terrain Study Users' Manual (Gartner, Mollard, and Roed, 1980), a companion publication to this series of maps and reports.

Appreciation is expressed to the Ontario Geological Survey for providing a manuscript copy of the aggregate inventory map for the area, prepared by E.V. Sado.

2.0 GEOLOGIC SETTING

The Blue Lake area is underlain by crystalline bedrock of Precambrian age, which is covered by a discontinuous mantle of Quaternary surficial deposits. The terrain is dominated by rugged, rocky uplands and lowlands, except for the northeastern part where there is a rolling glaciolacustrine clay plain. The most distinctive surficial feature is a complex moraine-like ridge that trends northwest across the northeastern part of the map-area. Ground moraine is restricted to a few isolated patches in the western part of the area, and glaciofluvial terrain, except where it occurs in association with the major moraine-like ridge, is rare. Alluvium is poorly developed and highly organic in most places. Numerous small patches of organic terrain occupy depressions in the bedrock terrain and the glaciolacustrine plain.

2.1 BEDROCK GEOLOGY

The map-area, which lies within the Wabigoon Belt in the Superior Structural Province of the Canadian Shield, is underlain by two con-

trasting bedrock types, both of Early Precambrian age. The oldest rocks are supracrustal in origin and comprise two highly folded belts of mafic to felsic metavolcanics and metasediments, with lesser amounts of mafic to ultramafic and felsic intrusives. The larger of these belts surrounds Eagle Lake, while two segments extend south and southwest from Eagle Lake to the southern margin of the map-area. The second belt extends from Willard Lake to Langton Lake in the northwestern part of the area. A large mafic to ultramafic intrusive body southwest of Eagle Lake is associated with the larger metavolcanic-metasedimentary belt. The remainder of the map-area is underlain by largely undifferentiated felsic igneous and metamorphic rocks. A northwest-trending Middle to Late Precambrian diabase dike occurs northeast of Eagle Lake (Davies and Pryslak 1967).

The portion of the larger metavolcanic-metasedimentary belt cutting through Eagle Lake and extending southwest through Fisher Lake has high to medium mineral potential for gold-silver. The smaller belt in the northwestern part of the area has high potential for uranium. Mineral potential of the remainder of the area (the felsic intrusive and metamorphic rocks) is rated as medium to "least" (Springer 1978).

2.2 QUATERNARY GEOLOGY

Northwestern Ontario was affected by several stages of continental glaciation during the Pleistocene. However, only deposits of the last glaciation, the Laurentide of Wisconsinan age, are preserved in the Blue Lake area. The ice began to advance approximately 100 000 years ago and travelled as far south as central Wisconsin before receding. The ice disappeared from the Blue Lake area approximately 15 000 years ago (Prest 1970). Zoltai (1961) gives a more complete account of the glacial history of the region.

Widespread stagnation of the ice mass resulted in the deposition of a variety of surficial materials. Till was deposited directly by the ice in the form of ground moraine and hummocky moraine. Meltwater from the glacier formed glaciofluvial outwash deposits and kames, and was a major contributor to the formation of the moraine-like ridge which passes through Vermilion Bay. Ponded meltwater accumulated in low-lands to form glacial lakes. These lakes grew in size and eventually coalesced to form an enormous body of water called Glacial Lake Agassiz.

Deposits of glaciolacustrine silt and clay occur in the lowlands adjacent to Eagle Lake. In some places, bedrock hills were swept clean of unconsolidated material during high water stages of Glacial Lake Agassiz, as evidenced by numerous bare bedrock knobs. In other parts of the area, the bedrock topography was completely covered by the lake deposits. In the rugged rocky uplands characteristic of the western part of the map-area, the glacier overdeepened valleys, rounded off bedrock outcrops, and left scattered deposits of moraine and boulders. Glacial lake water did not inundate large parts of these rocky uplands.

The complete disappearance of glacial ice and gradual draining or drying up of glacial lakes marked the end of the Pleistocene Stage of the Quaternary Period in the area. Since that time, approximately 9 000 years ago (Prest 1970), modern streams have developed alluvial flood plains and organic deposits have accumulated in wet depressions. These deposits are nonglacial in origin and, together with the various glacial materials, comprise the variety of Quaternary unconsolidated deposits that forms a discontinuous mantle over the bedrock in the Blue Lake area.

2.3 PHYSIOGRAPHY

Rugged bedrock terrain of high relief dominates the central part of the map-area, while low relief bedrock terrain occupies the lowland around Eagle Lake. Elevations range from 363 m at Eagle Lake to 513 m in uplands northwest of Porcus Lake in the western part of the area. A rolling clay plain, which flanks the valley of the Wabigoon River, is a northwesterly extension of the Dryden Clay Plain. The moraine-like ridge is generally flat topped, has an average width of about 1 km, and ranges in elevation from 396 m to 427 m.

3.0 ENGINEERING TERRAIN UNITS

Engineering terrain units are composed of a combination of various materials (unconsolidated and/or bedrock) which form recognizable landforms with certain engineering characteristics. Major terrain unit groups, and the engineering significance of each, are discussed in detail. These include bedrock terrain (RN, RR), moraine (MG, MH, LB) and glaciolacustrine plains (LP). Less significant units include glaciofluvial deposits (GO), organic terrain (OT), and alluvial plains (AP). A diagram-

matic sketch of a typical terrain setting is given in Figure 1. Table 1 summarizes the characteristics and engineering significance of the major terrain units in the Blue Lake area.

3.1 BEDROCK

Examples: $\frac{RN(tsMG)}{Hnj-D}$

$\frac{RN(tsMG)}{Lu-D}$

$\frac{RN(cmLP)}{Ln-D}$

$\frac{RR(tsMG)}{Mnrj-D}$

Bedrock terrain dominates the map-area. It varies from a rugged, ridged unit (RR) west of Fisher Lake in the southern part to undulating (u), knobby (n) or hilly units (RN) throughout the remainder of the area. The topography is generally rugged (j) and local relief is moderate to high (M-H). The west-central part of the map-area is particularly high and rugged. Bedrock terrain is dry (D), except in low-lying depressions. Prominent scarps are common, especially in the ridged unit. Thin, discontinuous patches of till (tsMG) are associated with the bedrock terrain and, in the lowland adjacent to Eagle Lake, varved silty clay (RN(cmLP)) occupies most depressions in this terrain unit. Organic material occurs in small depressions which are very poorly drained.

The main engineering significance of bedrock terrain is that it is difficult and expensive to excavate. Also, because of the rugged topographic character, extreme alignment techniques and deep cuts and fills are necessary for adequate road construction. In many places, this terrain unit has a limited supply of unconsolidated material and a shortage of available aggregate. Importation of materials is often necessary and involves substantial expense. It has been observed, however, that thick blankets of ground moraine till do occur in association with some bedrock landforms. Careful exploration for these moraine occurrences could substantially decrease engineering difficulties in bedrock terrain. Local deposits of glaciofluvial sand and gravel are to be expected and some raised beach gravel deposits occur along rock-buttressed shorelines, but generally aggregate is scarce. Rock is quarried for ballast in MacNicol Township and for granite building stone in Docker Township (Pryslak 1976).

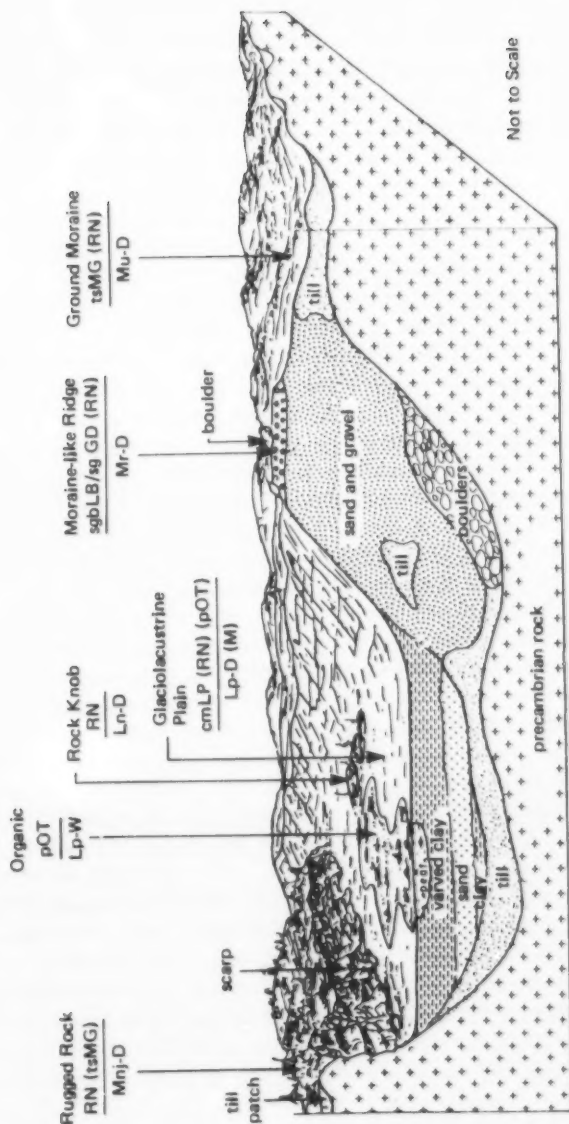


FIGURE 1 — DIAGRAMMATIC SKETCH SHOWING TYPICAL TERRAIN TYPES AND THEIR REPRESENTATIVE LETTER SYMBOLS.

Groundwater occurs in fractures and along fault zones in the bedrock, but this terrain unit is considered to have only poor to fair potential for groundwater supplies. Bedrock terrain is unsuitable for surface waste disposal of any kind, except where there is a thick layer (at least 1.5 m) of attenuating soil material.

3.2 MORAINE

Examples: $\frac{\text{sgLB/sgtGD}}{\text{Lu-D}}$ $\frac{\text{tsMG/RN(RN)}}{\text{Mn-D}}$ $\frac{\text{tsbMH(RN)}}{\text{Mn-D}}$

Moraine in this area includes a major complex, moraine-like feature, as well as widely separated patches of ground moraine and minor hummocky moraine. The complex moraine-like ridge is topographically prominent, nearly flat (u) on top, and composed of up to 30 m of cross-stratified gravelly sand or sandy gravel of deltaic origin (sgGD) (see Figure 1). It contains patches and inclusions of till (t) and is capped by 1 to 2 m of horizontally bedded pebble to bouldery beach gravel of glaciolacustrine origin (sgLB) with interbeds of silt or clay. Large boulders are scattered along the top of the feature in associated beach deposits and, in some instances, form appreciable concentrations (e.g. the curious boulder fields in the vicinity of Blue Lake Provincial Park in the northern part of the area). The moraine abuts bedrock in places, has a well-defined raised beach scarp in others, and is partly covered at its base by glaciolacustrine silty clay.

Small areas of ground moraine (MG) and occasionally hummocky moraine (MH), both composed of sandy till (ts), occur mainly in the western part of the map-area. The unit on the west side of Berry River appears to be the thickest, perhaps exceeding 20 m. Relief is low to moderate (L-M), topography is undulating (u) to knobby (n), and the terrain is well drained (D). Bedrock knobs (RN) are always associated with both types of moraine. Very narrow, northwest-trending till ridges up to 3 km in length occur in the extreme northeastern part of the area.

The engineering significance of the moraine-like ridge is substantial. It is the only large deposit of well-drained surficial aggregate in the entire map-area and has been heavily worked around Vermilion Bay. Although sand-sized material is the dominant component, extensive gravel lenses

TABLE 1 SUMMARY OF TERRAIN UNIT CHARACTERISTICS AND ENGINEERING SIGNIFICANCE, BLUE LAKE AREA

TerraIn Unit and Location	CLASSIFICATION		ENGINEERING USE			
	Material; Relief; Topography; Drainage	General Construction	Transportation Routes	Waste Disposal	Groundwater Supply	Major Constraints
BEDROCK TERRAIN (RN), western, southern, and northeastern parts of the area	rock; relief varies from low to high (less than 60 m); rugged drainage good	excavations are necessary for most types of construction	blasting required; aggregate in small pockets	high pollution potential	domestic supply available from deep wells in most places	blasting, lack of aggregate
GROUND MORaine (MG), HUMMOCKY MORaine (MH), western part of the area	till, sand, and boulders (tsb); moderate relief; undulating to knobby; dry	minor excavation necessary; source of fill	aggregate in pockets; suitable sub-base	suitable for waste disposal where till is thick	domestic supply available where deposit is thick	deposits are not extensive
GLACIOFLUVIAL DELTA MORaine COMPLEX (GDI), a linear belt crossing the northeast part of the area	sand, gravel, and boulders (sfb); low relief; undulating and ridged; good drainage	only minor re-grading necessary in some places	excellent; aggregate material is readily available	pollution potential is high due to permeability	large yields possible where deposits are thick	variation in aggregate quality
GLACIOFLUVIAL (GI), close to Vermilion Bay, Willard Lake, and scattered in pockets throughout bedrock terrain	sand and gravel (sg) predominate; low relief; undulating; drainage generally good	favourable for most types of construction	aggregate readily available	pollution potential is high due to permeability	large yields possible where deposits are thick	deposits are small

GLACIOLACUSTRINE PLAIN (LP) , a wide belt crossing the northeastern part of the area	clay and silt (cm) predominate; low relief; planar to undulating; drainage good	easily excavated; frost susceptible; low bearing capacity for large structures	aggregate must be imported	suitable for waste disposal where deposits are thick and water table low	large bore shallow wells supply domestic needs in places	frost susceptible; low bearing capacity for large structures; lack of aggregate
GLACIOLACUSTRINE BEACHES (LB) , along the major moraine-like ridge	sand and gravel (sg); low relief; ridged and knobby; drainage good	only minor re-grading necessary in places	aggregate readily available	pollution potential is high since deposits are permeable	large yields possible where deposits are thick	large boulders in places
ORGANIC TERRAIN (OT) , in low-lying depressions throughout the map-area	peat (p); low relief; planar; drainage poor	low bearing capacity; frost susceptibility; highly compressible	unsuitable for subgrade except for light vehicle roads	pollution potential is high	quality and quantity of water are poor	low strength; poor drainage; high frost susceptibility

Comments: Alluvial plains occur along most streams but most are too small to map at this scale.

are present. Also, the unit is capped with a layer of beach gravel that provides good quality aggregate in many places. The flat, well-drained upper surface of the ridge, combined with the excellent foundation characteristics of the materials, provides an optimum site for construction of foundations, runways, roads, and other structures. However, care should be exercised to ensure that construction on this feature does not prevent the future utilization of all good quality aggregate supplies in any particular locality.

The water table is generally very low within the unit, but where a sufficient portion of the material lies below the water table, it could form a very important groundwater aquifer. Because of its groundwater potential and its porous nature, the unit is generally not suitable for waste disposal apart from widely spaced septic drain tile fields.

Where lake shores occur along the edge of the moraine-like ridge, extensive high quality (in terms of recreation resources) sand beaches have developed. The shoreline of Blue Lake in the northern part of the area is an excellent example.

Ground moraine and hummocky moraine, although rare in this map-area, are well drained and excellent sources of well-graded fill. Foundation conditions are good and the deposits are usually suitable for waste disposal. Groundwater potential is considered poor to fair where the deposits lie below the water table.

3.3 GLACIOFLUVIAL

Examples: $\frac{sgGO(RN)}{Ln-D}$

$\frac{sgGO(tsMG)(RN)}{Mn-D}$

$\frac{sgGO/RN}{Lp-D}$

Glaciofluvial terrain consists of scattered patches of outwash sand and gravel, a subsurface deposit (see Section 3.4) near Hellsten Lake immediately north of the town of Vermilion Bay, and the material which forms most of the moraine-like feature discussed in Section 3.2. Minor pockets of glaciofluvial material occur in bedrock terrain. Usually the glaciofluvial terrain unit (GO) forms low relief plains (Lp) and consists of gravelly sand (sgGO), but it is of minor importance in this area. The unit is well drained (D), except along modern drainage channels where conditions are mixed (M).

Glaciofluvial deposits are potential sources of surficial aggregate and provide good foundation conditions where drainage is adequate. The unit is also considered a good potential groundwater aquifer. It is unsuitable for waste disposal, except for widely separated septic drain tile fields.

3.4 GLACIOLACUSTRINE

Examples:	$\frac{\text{cmLP(RN)}(\text{pOT})}{\text{Lun-D(M)}}$	$\frac{\text{cmLP(RN)}(\text{pOT})}{\text{Ludp-D(W)}}$	$\frac{\text{sgLB}}{\text{Lp-D}}$
-----------	---	--	-----------------------------------

Varved silty clay is widespread in the lowlands which occupy the north-eastern part of the map-area. The clay is calcareous and shades of gray in colour. A distinctive maroon-coloured clay band is present and is particularly noticeable in the rolling terrain southeast of the settlement of Red Lake Road. The clay is at least 15 m thick in places, but due to irregularities in the underlying bedrock surface, its thickness varies considerably. The unit generally forms a flat to undulating plain (up) above which bedrock knobs (n) commonly protrude. In the eastern part of the map-area, the plain appears to have been dissected (d).

Extensive organic deposits (pOT) overlie the clay in flat, poorly drained locations. In most other places, the clay plain is well drained (D). Southwest of McLaws Lake in Sanford Township, the clay is underlain by an extensive subsurface glaciofluvial sand and gravel (sgGO) unit; in the vicinity of Hellsten Lake, immediately north of the town of Vermilion Bay, the clay is also associated with a glaciofluvial (GO) unit. Glaciolacustrine silt and clay occurs widely in association with bedrock terrain, especially in the lowland bordering Eagle Lake; however, much of the west-central portion of the map-area appears to be devoid of glaciolacustrine material.

A raised beach of glaciolacustrine origin, which defines the top of the major moraine-like ridge, is discussed in Section 3.2. Minor raised beaches occur above mean lake levels in several places (e.g. the northern shore of Ethelma Lake near the western margin of the area).

The glaciolacustrine silt and clay plains are ideally suited for the excavation involved in engineering projects such as pipeline and transportation routes. The material is easy to handle and is dry in many places, although wet conditions do exist locally. It tends to settle, which makes it a poor

fill material, and generally is highly frost susceptible, which reduces its suitability for foundations. Bank stability in the glaciolacustrine unit is a potential problem along the steep slopes of river banks and along shorelines subject to wave action.

Interbedded sand layers may occur at depth and would form potential groundwater aquifers, but generally the unit is a poor source of groundwater. The upper part of the clay is fractured, and dug wells in this unit supply water in some locations. Glaciolacustrine terrain is generally suitable for waste disposal and septic drain tile field installation. Sanitary landfill operations will experience difficult working conditions during winter months when the sediments are frozen.

3.5 ALLUVIAL

Examples: $\frac{\text{pAP}}{\text{Lp-M}}$

$\frac{\text{spAP}}{\text{Lp-M}}$

Alluvial terrain, which occurs along some streams but is generally too limited in area to map, consists mainly of peat with some silt, sand, or peaty sand (spAP). Almost all localities are poorly drained (W or M).

Alluvial terrain may be subject to flooding. Due to the predominance of fine-grained and organic materials, it is a very poor foundation material. Groundwater potential is poor and the unit is unsuitable for waste disposal.

3.6 ORGANIC

Examples: $\frac{\text{pOT}}{\text{Lp-W}}$

$\frac{\text{pOT(RN)}}{\text{Lp-M}}$

$\frac{\text{pOT/cmLP(RN)}}{\text{Lp-M}}$

Organic terrain composed of peat (pOT) is common, especially in lowlands adjacent to lake bays and along poorly developed drainage systems. Organic deposits are very poorly drained and are either wet throughout the year (W) or for part of the year (M).

Construction is difficult and expensive in organic terrain due to the poor drainage and the low strength, low bearing capacity, high compressibility,

and extremely high frost susceptibility of the soil materials. Groundwater potential is low and water quality is poor. Organic terrain is not suitable for waste disposal.

4.0 REFERENCES

Davies, J.C. and Pryslak, A.P.

- 1967: Kenora-Fort Frances Sheet, Kenora and Rainy River Districts; Ontario Department of Mines, Map 2115, Geological Compilation Series, scale 1:253 440 or 1 inch to 4 miles. Geological compilation 1963-1965.

Gartner, John F, Mollard, J.D., and Roed, M.A.

- 1980: Ontario Engineering Geology Terrain Study Users' Manual, Ontario Geological Survey, Open File Report 5288, 99 p.

Hills, G.A. and Morwick, F.F.

- 1944: Reconnaissance Soil Survey of Parts of Northwestern Ontario; Ontario Soil Survey, Report No. 8, 56 p.

Prest, V.K.

- 1970: Quaternary Geology of Canada; p. 675-764 in *Geology and Economic Minerals of Canada*, edited by R.J.W. Douglas, Geological Survey of Canada, Economic Geology Report No. 1, 5th edition, 838 p.

Pryslak, A.P.

- 1976: Geology of the Bruin Lake-Edison Lake Area, District of Kenora; Ontario Division of Mines, Geoscience Report 130, 61 p. Accompanied by Maps 2302, 2303, scale 1:31 680 or 1 inch to ½ mile.

Springer, Janet

- 1978: Ontario Mineral Potential, Dryden Sheet, Districts of Kenora and Rainy River; Ontario Geological Survey, Preliminary Map P.1530, Mineral Deposits Series, scale 1:250 000. Compilation 1977, 1978.

Zoltai, S.C.

- 1961: Glacial History of Part of Northwestern Ontario; Proceedings of the Geological Association of Canada, Vol. 13, p. 61-83.
- 1965: Surficial Geology, Kenora-Rainy River; Ontario Department of Lands and Forests, Map S165, scale 1:506 880 or 1 inch to 8 miles. Surficial geology 1958-1960.

**MAPS
NOT
FILMED**

**CARTES
OMISES**